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CATALOG of the Evening School of Engineering

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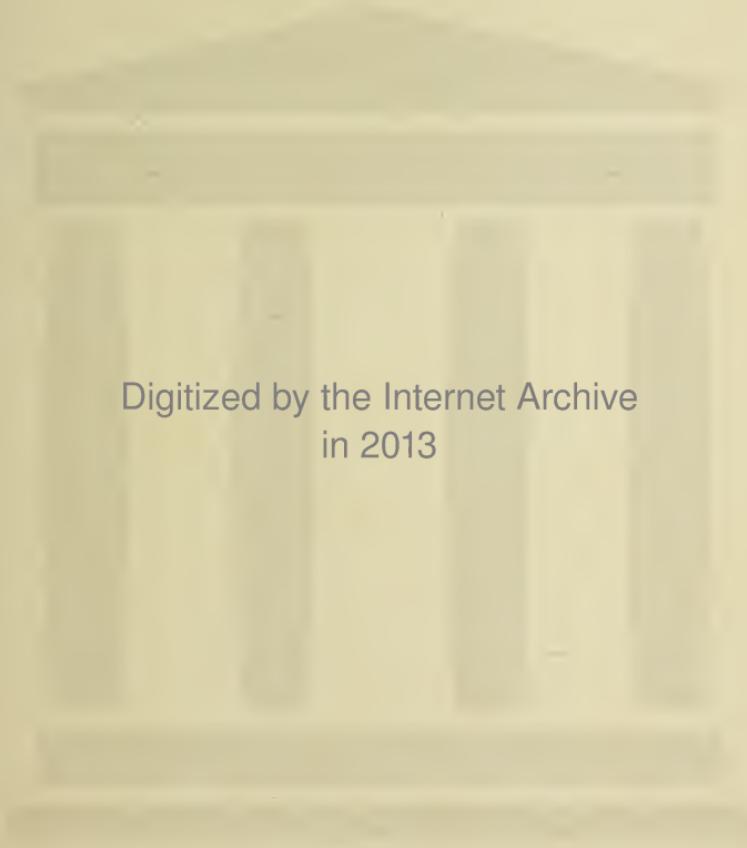
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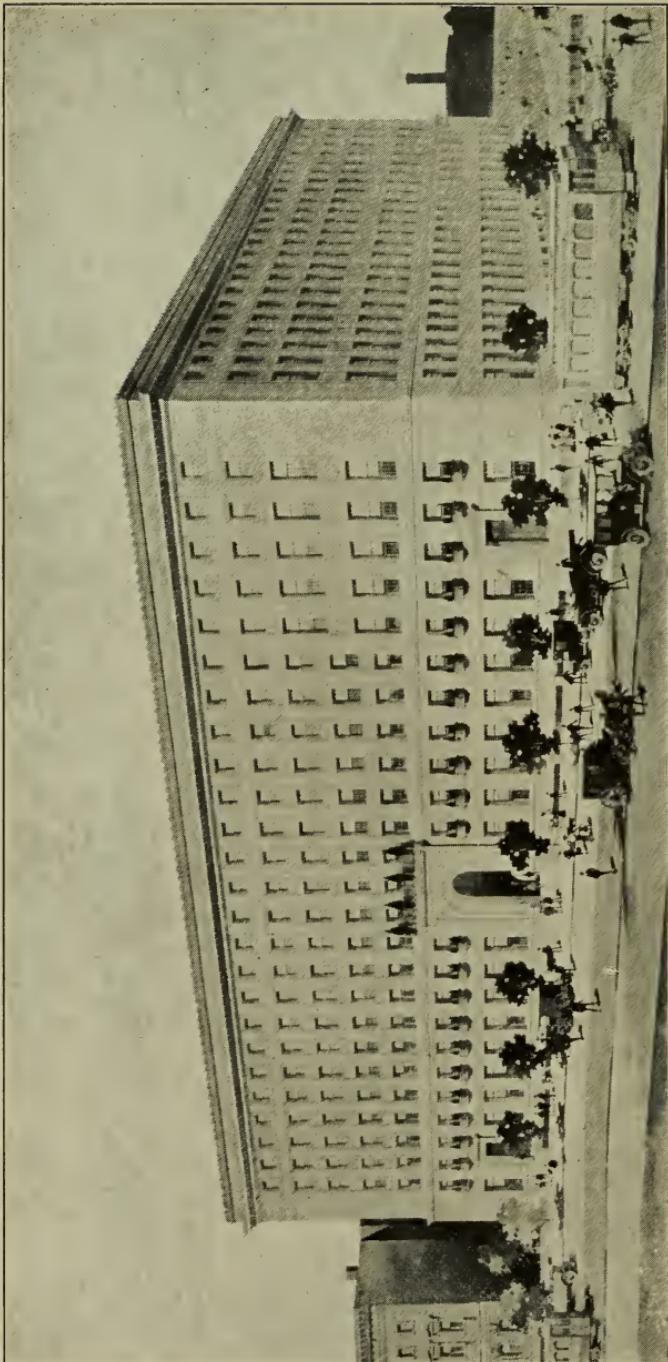
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Evening School
1920-21



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THE ASSOCIATION BUILDING
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Northeastern College

CATALOG of the Evening School of Engineering



1920-1921

316 Huntington Avenue
BOSTON, MASSACHUSETTS

CALENDAR 1920-21

September 13-18

Registration

September 20

Opening of First Term

October 12

Columbus Day (School exercises omitted)

November 25

Thanksgiving Day (School exercises omitted)

December 23

End of First Term

December 24-31 inclusive

Christmas Recess

January 3

Opening of Second Term

February 22

Washington's Birthday (School exercises omitted)

April 8

End of Second Term

April 9

Close of School

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GENERAL INFORMATION

Many men in various lines of industry feel the need of special instruction in Engineering, either to advance in their normal occupation, or to enable them to change their positions and get into work of an Engineering nature.

To such men the Evening School of Engineering offers a wide variety of regular Engineering Courses, and in addition, special instruction for those who desire it, in Architecture, Drawing, Design, Radio Telegraphy and Concrete Construction. The Engineering Courses require attendance three evenings a week, during a period of three years. While only the fundamental subjects are taken up, the courses compare very favorably with similar courses offered by the good technical schools.

Three-year Engineering Courses

Regular three-year courses, leading to a diploma, are offered in the following branches of Engineering:

- I Civil Engineering
- II Mechanical Engineering
- III Electrical Engineering
- IV Chemical Engineering
- V Structural Engineering

Special Courses

Special courses in Architecture, Concrete Construction and Radio Telegraphy are offered by the School, and will be found described in detail in the latter part of this catalog.

Requirements for Admission

The work carried on in the Engineering Courses assumes that the entering student has had previous training in Elementary Algebra to quadratics, Plane Geometry, and has a good ground-work in English. An entering student should have completed at least the equivalent of from one or two years' work in a good high school. Those who have completed a full high-school course should be well fitted to carry on the courses and derive the maximum benefit from the work.

The men who finished grammar school, but who had not

EVENING SCHOOL OF ENGINEERING

had the requisite previous training in Mathematics and English, can attend the Evening Courses of the Northeastern Preparatory School, and should be able to get the necessary preparation for entrance to the Engineering School in from one to two years.

There are no entrance examinations for entering students, but each applicant for admission is required to have an interview with the Dean.

The qualifications of each applicant will be ascertained and he will be advised as to just what work he is qualified to undertake.

Should a student prove to be unable to carry on his studies successfully, he may be required to discontinue any subject in which he is deficient, and complete such preparatory work as is deemed necessary, before being re-admitted to the subject in question.

Tuition Fees

For each year of the regular three-year Engineering Courses the tuition fee is sixty dollars. The tuition fee includes membership in the Association. This amount is payable as follows:

\$30.00 upon entering the School
\$15.00 November 15
\$15.00 January 15

The tuition fee for special courses will be found on page 38.

Refunds

Refunds will be granted in accordance with the regular rules of the College. In computing refunds, students shall be charged at the rate of three dollars per week for each week of school attendance, and in addition to this, shall be charged an extra six dollars, over and above this weekly rate. The date of withdrawal of any student shall be taken as the day on which the School receives formal notice of his intentions to leave.

Laboratory Fees

All students taking courses in the Chemical Laboratories

GENERAL INFORMATION

are charged a laboratory fee of five dollars. This fee is payable in advance and does not cover breakage or destruction of apparatus. It is non-returnable.

An additional laboratory deposit of five dollars must be made before a desk will be assigned to a student. At the close of the school year the cost of equipment, broken by the student or, not returnable will be deducted from this amount and the balance refunded. Students failing to check up their desks upon leaving school will be charged one dollar extra.

Transfers

No student is permitted to transfer from one course to another without consulting the Dean beforehand and receiving a transfer order, which must be presented at the School office for the proper transfer card.

Reports of Standing

An informal report of the students' standing is issued at the end of the first term, and a formal report, covering the year's work, is issued at the close of each year.

Positions Held by Graduates

The graduates of the School are in constant demand, and it may be said that those who complete one of the courses successfully can be sure of desirable employment in his chosen line.

Naturally the School does not guarantee to place its graduates in positions. This is not necessary since our graduates have no difficulty in finding places for themselves.

Special Students

A special student may take any subject, upon the approval of the Dean, provided he has had the necessary preliminary training.

Scholarships

As an aid to worthy men who desire an education and are unable to pay the tuition fees, a limited number of scholarships

EVENING SCHOOL OF ENGINEERING

has been provided, which will be granted by the Board of Governors, to whom application should be made in writing. Students who can afford to pay are requested not to apply for this privilege.

Diplomas

Upon the satisfactory completion of any of the regular courses, the student is entitled to receive a diploma.

COURSES OF STUDY

GENERAL STATEMENT

The schedules of the various courses are given on the following pages. The first-year work of all courses is practically the same, with a few exceptions, which are made because of the need of the student for elementary training in his professional subjects.

The school year comprises twenty-eight weeks of class work and examinations. The twenty-eight weeks are divided into two terms of fourteen weeks each. The subjects in the Course Outlines on the following pages have been arranged by terms. Opposite these subjects will be found the number of periods of forty-five minutes each of class, recitation, laboratory or the drawing room work. The number in parenthesis, following the subject, is the number by which that subject is identified in the description matter under "Subjects of Instruction."

When a student elects a course, he is required to complete all subjects in that course in order to receive a diploma. No subject is to be dropped, or omitted, without the consent of the Dean.

COURSES OF STUDY

I. CIVIL ENGINEERING

The purpose of this course is to give the student an education in those subjects which form the basis of all branches of technical education, and a special training in those subjects comprised under the term "Civil Engineering." It is designed to give the student sound training, both theoretical and practical, in the sciences upon which professional practice is based.

Civil Engineering covers such a broad field that no one can become expert in its whole extent. It includes Topographical Engineering, Municipal Engineering and Railroad Engineering. It covers land surveying, the construction of sewers, waterworks, roads and streets. All these branches of Engineering rest, however, upon a relatively compact body of principles, and in these principles the students are trained by practice in the class room, drawing room and the field.

The course is designed to prepare the young engineer to take up the work of assisting in the location and construction of steam and electric railways, sewerage and water supply systems, etc.

FIRST YEAR

FIRST TERM	Periods per week	SECOND TERM	Periods per week
Algebra (1)	2	Trigonometry (4)	2
Geometry (2)	1	Logarithms and Slide Rule (3) . . .	1
Practical Physics (8)	2	Practical Physics (8)	2
Practical Physics Problems (9)	1	Practical Physics Problems (9)	1
Mechanical Drawing (10)	3	Mechanical Drawing (10)	3

SECOND YEAR

FIRST TERM	Periods per week	SECOND TERM	Periods per week
Analytical Geometry (5)	2	Calculus (6)	2
Surveying (11)	4	Surveying (11)	4
Topographical Drawing (12)	2	Topographical Drawing (12)	2
Highway Engineering (13)	1	Highway Engineering (13)	1

THIRD YEAR

FIRST TERM	Periods per week	SECOND TERM	Periods per week
Practical Mechanics (16)	2	Practical Mechanics (16)	2
Hydraulics (27)	2	Strength of Materials I (17)	2
Railroad Engineering (14)	2	Railroad Engineering (14)	2
Railroad Engineering Drawing (15) . .	3	Railroad Engineering Drawing (15) . .	3

EVENING SCHOOL OF ENGINEERING

II. MECHANICAL ENGINEERING

This course is designed to give a foundation in those fundamental subjects which form the bases for all professional engineering practice, and especially to equip the young engineer with a knowledge of the various phases of Mechanical Engineering. The course embraces instruction by text-book, lecture, and drawing room.

The course affords training in the methods, and gives practice in the process of Construction, which develops in the student the capacity for thinking along mechanical lines, thus enabling him to base all his work upon fundamental principles already learned, rather than upon empirical rules. It is the endeavor to give the student a good theoretical training and meanwhile devote sufficient time to the practical work, so that he may become a proficient engineer, both in theory and in practice in the various branches of Mechanical Engineering.

FIRST YEAR

FIRST TERM	Periods per week	SECOND TERM	Periods per week
Algebra (1)	2	Trigonometry (4)	2
Geometry (2)	1	Logarithms and Slide Rule (3) . . .	1
Practical Physics (8)	2	Practical Physics (8)	2
Practical Physics Problems (9)	1	Practical Physics Problems (9)	1
Mechanical Drawing (10)	3	Mechanical Drawing (10)	3

SECOND YEAR

FIRST TERM	Periods per week	SECOND TERM	Periods per week
Analytical Geometry (5)	2	Calculus (6)	2
Practical Mechanics (16)	2	Practical Mechanics (16)	2
Materials of Construction (25)	2	Strength of Materials I (17)	2
Mechanical Engineering Drawing (22)	3	Machine Drawing (23)	3

THIRD YEAR

FIRST TERM	Periods per week	SECOND TERM	Periods per week
Strength of Materials II (18)	2	Foundations (26)	2
Hydraulics (27)	2	Hydraulic Motors (28)	2
Thermodynamics (29)	2	Thermodynamics (29)	2
Machine Design (24)	3	Machine Design (24)	3

COURSES OF STUDY

III. ELECTRICAL ENGINEERING

Electrical Engineering has developed rapidly in recent years and students are required to have a thorough appreciation of physical theory, as well as a broad working knowledge of Mathematics. It is essential that students planning to take this course should realize the fundamental necessity of obtaining a solid grounding in these subjects.

It is not the purpose of the course to attempt the impossible aim of turning out fully trained engineers in the various branches of the science, especially as it is becoming daily more and more differentiated and specialized. The course is designed rather to lay a broad and thorough foundation for future progress along the lines of work which may particularly appeal to the individual, and give him a good working acquaintance with the essential principles which underlie each of the more specialized branches of professional activity. Parallel with the theoretical work, runs a carefully planned course of laboratory work which is intended to develop the student's powers of planning work for himself.

FIRST YEAR

FIRST TERM	Periods per week	SECOND TERM	Periods per week
Algebra (1)	2	Trigonometry (4)	2
Geometry (2)	1	Logarithms and Slide Rule (3) . .	1
Practical Physics (8)	2	Practical Physics (8)	2
Practical Physics Problems (9) . . .	1	Practical Physics Problems (9) . . .	1
Mechanical Drawing (10)	3	Mechanical Drawing (10)	3

SECOND YEAR

FIRST TERM	Periods per week	SECOND TERM	Periods per week
Analytical Geometry (5)	2	Calculus (16)	2
Practical Mechanics (16)	2	Practical Mechanics (16)	2
Direct Currents, Lectures (30) . . .	2	Direct Currents, Lectures (30) . . .	2
Direct Currents, Laboratory (31) . .	3	Direct Currents, Laboratory (31) . .	3

THIRD YEAR

FIRST TERM	Periods per week	SECOND TERM	Periods per week
Alternating Currents, Laboratory (33) .	3	Alt. Currents, Lectures (32)	2
Alternating Currents, Lectures (32) . .	2	Alt. Currents, Laboratory (33) . . .	3
Hydraulics (27)	2	Hydraulic Motors (28)	2
Thermodynamics (29)	2	Thermodynamics (29)	2

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IV. CHEMICAL ENGINEERING

The great industrial advance of recent years has placed the chemical industry in the front rank of progress. The most potent reason for this may be found in the replacement of the old rule-of-thumb methods with scientific methods.

Owing to keen competition, manufacturers have been compelled to utilize every product of their plants, and this has called for skilled chemical knowledge. The course in Chemical Engineering has for its purpose the training of students competent to take responsible places in the operation of industries based on chemical principles.

During their course many students are employed in chemical industries as gas manufacturing plants, chemical engineering companies, etc. They not only get an excellent training in the theory of such work at school, but also a knowledge of the commercial side of the industry as well.

The class work includes a training in Inorganic, Analytical, and Organic Chemistry, which is accompanied by appropriate laboratory work.

FIRST YEAR

FIRST TERM	Periods per week	SECOND TERM	Periods per week
Algebra (1)	2	Trigonometry (4)	2
Chemical Physics (7)	2	Chemical Physics (7)	2
Inorganic Chemistry, Lectures (34)	2	Inorganic Chemistry, Lectures (34)	2
Inorganic Chemistry, Laboratory (35)	3	Inorganic Chemistry, Laboratory (35)	3

SECOND YEAR

FIRST TERM	Periods per week	SECOND TERM	Periods per week
Analytical Chemistry, Lectures (36)	2	Analytical Chemistry, Lectures (36)	2
Analytical Chemistry, Laboratory (37)	7	Analytical Chemistry, Laboratory (37)	7

THIRD YEAR

FIRST TERM	Periods per week	SECOND TERM	Periods per week
Organic Chemistry, Lectures (38)	2	Organic Chemistry, Lectures (38)	2
Organic Chemistry, Laboratory (39)	6	Organic Chemistry, Laboratory (39)	6

COURSES OF STUDY

V. STRUCTURAL ENGINEERING

The purpose of this course is to give the student a special training in those subjects comprised under the term "Structural Engineering." It is designed to give the student sound and thorough training in the science upon which professional practice is based.

Structural Engineering covers such a broad field that no one can become expert in its whole extent. It includes the design and construction of girders, columns, roofs, trusses, arches, bridges, buildings, walks, dams, foundations and all fixed structures and movable bridges. It includes also a knowledge of the relative merits of the design and construction of buildings, bridges and structures composed of different materials used by the engineer, such as concrete, reinforced concrete, timber, cast iron and steel.

The course is designed to prepare the young engineer to take up the work of assisting in the design and construction of structures; to undertake intelligently supervision of erection work in the field and general contracting.

FIRST YEAR

FIRST TERM	Periods per week	SECOND TERM	Periods per week
Algebra (1)	2	Trigonometry (4)	2
Geometry (2)	1	Logarithms and Slide Rule (3) . . .	1
Practical Physics (8)	2	Practical Physics (8)	2
Practical Physics Problems (9) . . .	1	Practical Physics Problems (9) . . .	1
Mechanical Drawing (10)	3	Mechanical Drawing (10)	3

SECOND YEAR

FIRST TERM	Periods per week	SECOND TERM	Periods per week
Analytical Geometry (5)	2	Calculus (6)	2
Materials of Construction (25) . . .	2	Strength of Materials I (17)	2
Practical Mechanics (16)	2	Practical Mechanics (16)	2
Structural Drawing (19)	3	Structural Drawing (19)	3

THIRD YEAR

FIRST TERM	Periods per week	SECOND TERM	Periods per week
Strength of Materials II (18) . . .	2	Foundations (26)	2
Theory of Structures (20)	4	Theory of Structures (20)	4
Structural Design (21)	3	Structural Design (21)	3

SUBJECTS OF INSTRUCTION

Instruction is given by lectures and recitations, and by practical exercises in the field, the laboratories and the drawing rooms. A great value is set upon the educational effect of these exercises, and they form the foundation of each of the courses. Text-books are used in many subjects, but not in all. In many branches the instruction given differs widely from available text-books and in most of such cases, notes on the lectures and laboratory work are furnished to the students. Besides oral examinations in connection with the ordinary exercises, written examinations are held from time to time.

In the following pages will be found a detailed statement of the scope of the subjects offered in the various courses. The subjects are classified, as far as possible, related studies being arranged in sequence.

The subjects are numbered, or numbered and lettered, for convenience of reference in consulting the various Course Schedules.

The requisites for preparation include not only the subjects specified by number, but also those required as a preparation for them. The reason for this is that to carry on properly the more advanced subjects, the student must have become proficient in all the elementary subjects. Some studies, specified as being required in preparation, may be taken simultaneously. The student must complete such subjects before starting on more advanced work.

By careful consideration of the Course Schedules, in connection with the following Description of Subjects, the applicant for a special course may select, for the earlier part of that course, such subjects as will enable him to pursue later those more advanced subjects which he may particularly desire.

The topics, included in the list which follows, are subject to change at any time by action of the School authorities.

SYNOPSIS OF SUBJECTS

SYNOPSIS OF SUBJECTS

Regular Courses

1. Algebra

Preparation: Elementary Algebra

This course is taken by all regular students during the first term of the first year and consists of a general review of Algebra up to quadratic equations, and a continuation including quadratic equations, ratio and proportion, variation and the use of formulas, with applications to problems in Physics and Engineering.

2. Geometry

Preparation: Elements of Plane Geometry

This course is taken by all regular students during the first term of the first year. It consists of a rapid review of the useful theorems, with special reference to mensuration.

3. Logarithms and Slide Rule

Preparation: 1

In this course instruction is given in the theory of logarithms with thorough drill in their use, with applications to the solution of exponential equations, especially in formulas; the theory and use of Slide Rules, including a general discussion of precision and rules for significant figures.

4. Trigonometry

Preparation: 1, 2, 3

This course consists of lectures and recitations covering radians, coördinates, trigonometric ratios, formulas, law of sines, law of cosines, solution of right and oblique triangles, with applications to problems in Engineering.

5. Analytical Geometry

Preparation: 4

In this course instruction is given by lectures and recitations in the following subjects: Plotting of functions, interpolation, the straight line, the conic sections, curves represented by various equations of common occurrence in engineering, graphic solution of equations, determination of laws from the data of experiments, simplification of formulas.

EVENING SCHOOL OF ENGINEERING

6. Calculus

Preparation: 4 and 5

This course is taken by all regular engineering students during the second term of the second year. Instruction is given by lectures and recitations in the following subjects: rate of change, differentiation, integration, definite integrals, with application to the determination of mean value, area, volume, center of gravity and moment of inertia.

7. Chemical Physics

A course of experimental lectures and exercises, designed especially for students of Chemistry. The work is devoted to a study of the mechanics of solids, liquids and gases; heat and its effects; and elementary electricity. The problems are also planned to give drill work in Mathematics in its applications to Physics and Chemistry.

8. Practical Physics

Preparation: 1, 2

This course consists of two lectures per week throughout the first year. Instruction is given in the practical application of physical laws. Each lecture, so far as possible, is accompanied by practical tests in the lecture room on large-size apparatus, built especially for this course, so that the student may actually see a demonstration of the truth of the various laws, thus enabling him to grasp readily the underlying principles. The course is devoted to a study of the mechanics of solids, liquids and gases, heat and its effects, together with lectures on light and sound. Practical problems covering each phase of the work are given throughout the year, which are designed to fix in the student's mind the fundamental principles taken up in the lectures.

9. Practical Physics Problems

Preparation: 8

This course is taken by all regular students taking the course in Practical Physics (8), and is designed to give a more thorough understanding of the application of the principles discussed in the lectures to the solution of problems.

SYNOPSIS OF SUBJECTS

10. Mechanical Drawing

This course is of an elementary character, and is planned on the assumption that the student has had no experience in the use of drawing instruments. Instruction is given in the use of instruments, the T-square, triangles and French curves, and in the fundamental rules for making drawings. Simple geometrical constructions and the principle of orthographic projections are studied.

11. Surveying

Preparation: 4

The first term is devoted to a study of surveying instruments, the methods of making surveys, and the solution of problems in plane surveying.

In the second term, the methods used in topographic surveying, together with the problems relating thereto, are taken up in detail, as well as advanced and special problems in plane surveying. A study is also made of triangulation and barometric leveling.

Special emphasis is laid on the construction and use of the various kinds of maps and plans with which the surveyor should be familiar.

12. Topographical Drawing

Preparation: 10

The first half of the course is devoted to a study of the various conventional symbols used in the drawing of topographical maps. Each student is required to familiarize himself with these symbols and make an inked drawing containing several of them. Reasonable proficiency in the use and application to maps is expected. The latter part of the course is given over to the making of a contour map from field notes, then applying typical problems of earthwork, such as figuring volumes, balancing cuts and fills, grading, etc.

13. Highway Engineering

Preparation: 11

The course is outlined to give the student the principles and practice of modern highway engineering. This is not entirely a lecture course, for much time is given to the discussion and

EVENING SCHOOL OF ENGINEERING

relative merits of numerous phases of the subject. The first part of the course considers the preliminary investigation, design, drainage, foundations and layout, for gravel, earth and broken stone roads, including the use of bituminous materials. The latter part of the course considers several classes of pavements, including bituminous concrete, bituminous gravel and macadam, asphalt, wood-block, stone block, concrete and brick. Some time is also devoted to studying sidewalks, curbs, bridges, culverts and pipe systems.

14. Railroad Engineering

Preparation: 11

This course consists of instruction in the computation and methods of laying out simple, compound, reverse and easement curves; frogs, switches and turnouts; the computation of earthwork by different methods, slope stakes, borrow pits and cross-section work.

15. Railroad Engineering Drawing

Preparation: 10, 14

From field notes, a map and profile of a preliminary survey for a railroad are plotted, the location is discussed and adjusted to the preliminary map. Other drawings involving the study of problems common to railroad practice are taken up. The course is supplemented by lectures.

16. Practical Mechanics

Preparation: 4, 7, 8

A course of lectures and recitations which comprise a study of the general methods and applications of statics, including the determination of reactions, stresses in frames, of distributed forces and center of gravity, moment of inertia and radius of gyration of plane areas and solids. Kinematics and dynamics are also taken up, including the equations for uniform and varying rectilinear motion, centrifugal force, work, power and kinetic energy.

17. Strength of Materials I

Preparation: 16

This course comprises a study of the strength of materials, mathematically treated. The subjects studied are: the

SYNOPSIS OF SUBJECTS

stresses and strains in bodies subjected to tension, to compression and to shearing; common theory of beams, with thorough discussion of the distribution of stresses, shearing forces and bending moments; longitudinal shear, slopes and deflections, and the strength of shafts and springs.

18. Strength of Materials II

Preparation: 17

This is a continuation of Strength of Materials I in which a study is made of the combined stresses in beams subjected to tension and compression, as well as bending; also of the strength of hooks and columns, the design of riveted joints, and thin, hollow cylinders. A brief consideration of strains, and the relations of the stresses on different planes in a body, and the stresses in simple frames subjected to bending forces, is taken up in the latter part of the course.

19. Structural Drawing

Preparation: 10, 16

The course in structural drawing consists in the working out of various graphical problems of mechanics on the drawing board, drawing standard sections of structural steel shapes, structural details and the preparation of drawings, representing simple structures. The purpose of this course is to familiarize the student with detailed drawings and teach him where and how to dimension structural parts on working drawings.

20. Theory of Structures

Preparation: 18

This course consists of lectures, recitations and solution of problems. Instruction is given in the fundamental theory of structures, including the theory of beams, computation of reactions, moments, and shears for static and moving loads. The work in the classroom is supplemented by the solution of many practical problems in the drawing room.

21. Structural Design

Preparation: 19, 20

The course in structural design consists of work in the drawing room. It is a continuation of the course in structural drawing given in the second year, and includes the execution of elementary structural design, taking up in a practical way

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the principles given in the course in Theory of Structures. Each student is given data for various problems, the designs for which he works out in the drawing room, making all necessary computations and executing all drawings necessary for the preparation of a complete design of a number of engineering structures.

22. Mechanical Engineering Drawing

Preparation: 10

This course is a continuation of Mechanical Drawing, and includes problems on the point, line and plane; projections of solids; single and double curved surfaces and their intersections by oblique planes; and practical applications of the principles studied.

The principles of Mechanism are also studied. The problem work takes up the design of pulleys, belts, gearing and gear teeth development, cams and quick return motions used in machine tools such as shapers, slotters and planers.

23. Machine Drawing

Preparation: 10, 22

The aim of this course is to teach the proper way of making the necessary dimensioned drawings for use in practice, good shop systems being adopted. The instruction includes the making of working detail and assembly drawings of machinery from measurements.

24. Machine Design

Preparation: 18, 23

This course aims to give the student practice in the application of theoretical principles previously studied and at the same time acquaint him with the many practical details which must be considered in design work. The problems taken up in the early part of the course are of a static nature, while the later problems involve dynamical stresses. The problems of the course vary from year to year, but the following are typical of the designs taken up: arbor press, hydraulic flanging clamp, crane, air compressor, punch and shear, stone-crusher, etc.

SYNOPSIS OF SUBJECTS

In each design the constructive details are carefully considered, with special attention to methods of manufacture, provision for wear, lubrication, etc. The work is based on rational rather than empirical methods, the student being required to make all calculations for determining the sizes of the various parts and all necessary working drawings.

25. Materials of Construction

Preparation: 8, 16

This course consists of two lectures, or recitations during the first term of the second year, in the study of methods of testing and the strength of various materials used by the engineer. A detailed study is also made of the methods of manufacturing, properties and uses, of materials used in engineering work, such as lime, cement, concrete, brick, wood, stone, iron and steel.

26. Foundations

Preparation: 17, 18

A course covering the method of construction and design of the various kinds of foundations used in engineering construction, together with a study of the bearing power of different kinds of soil.

27. Hydraulics

Preparation: 6, 8

In this course both Hydrostatics and Hydrodynamics are discussed, and many practical problems are solved throughout the work. Under Hydrostatics, the pressures on submerged areas, together with their points of application, are studied; under Hydrodynamics, the flow of water through orifices, short tubes, nozzles, over weirs, and through pipes and open channels is taken up for discussion.

28. Hydraulic Motors

Preparation: 27

A series of exercises, mainly recitations devoted to a study of impulse wheels and reaction turbines, with reference to their proper construction, regulation and testing, and to the

EVENING SCHOOL OF ENGINEERING

various sources of loss of energy in their operation. Practical problems relating to stream flow, storage and development of water power are considered.

29. Thermodynamics

Preparation: 6, 8

A course in perfect gases and steam including the solutions of general problems and the use of steam and entropy tables. The work covers air compressors, refrigeration, gas engines, steam engines, turbines, and the equipment of a power house, boilers, condensers, and auxiliaries.

30. Direct Currents, Lectures

Preparation: 8

A course of lectures, recitations and problem work during the second year, dealing with the fundamental laws and properties of electric and magnetic circuits. The course is devoted to the study of the principles of direct-current machinery.

31. Direct Currents, Laboratory

Preparation: 30

This course of one evening per week is taken in connection with the corresponding classroom course in Direct Currents, and the experiments performed are intended to illustrate and supplement that work. Each student is required to furnish a complete report, including theory, method of procedure, results and conclusions on each experiment performed by him.

32. Alternating Currents, Lectures

Preparation: 30

A course of lectures, recitations and problem work during the third year, dealing with the principles of electromagnetism, electrostatics, variable currents and harmonic currents including both single-phase and polyphase circuits. A detailed study is made of the construction, theory and application of alternating-current machines.

SYNOPSIS OF SUBJECTS

33. Alternating Currents, Laboratory

Preparation: 31, 32

This course of one evening per week is taken in connection with the corresponding classroom work in alternating currents, and the experiments performed are intended to illustrate and supplement that work. Each student is required to furnish a complete report, including theory, method of procedure, results and conclusions on each experiment performed by him.

34. Inorganic Chemistry

Preparation: 7

A course of experimental lectures on the fundamental laws and principles of inorganic chemistry. The work aims to familiarize the student with the properties and preparation of the following elements and their most important compounds: —oxygen, hydrogen, the halogens, sulphur, nitrogen, phosphorus, carbon, silicon, the alkali and alkaline earth groups, iron and aluminum. The course is to be taken in conjunction with 35.

35. Inorganic Chemistry, Laboratory

Preparation: 34

A laboratory course in which the student is expected to verify and illustrate the facts and principles that have been discussed in the lectures. To be taken in conjunction with 34.

36. Analytical Chemistry, Lectures

Preparation: 34

A practical course in qualitative and quantitative analysis consisting of lectures relating to the separation and identification of the common metallic elements and the ordinary acids. The latter part of the year will be devoted to lectures and conferences on the fundamental principles of volumetric and gravimetric analysis.

37. Analytical Chemistry, Laboratory

Preparation: 36

This course in the laboratory is devoted to the separation and identification of common elements and acids in the

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laboratory. Each student is required to make a complete analysis of various mixtures, alloys and chemicals used in manufacturing. A study is also made of volumetric determinations involving the use and the standardization of burettes, pipettes and measuring flasks. The work includes alkalimetry, acidimetry, indicators, oxidimetry, iodimetry, chlorimetry.

38. Organic Chemistry

Preparation: 36, 37

The course is devoted to lectures and conferences on the underlying principles and theories of organic chemistry. A detailed study is made of the methods of preparation, and characteristic reactions of the carbon compounds, as illustrated by the methane and benzine derivations.

39. Organic Chemistry, Laboratory

Preparation: 38

In this course the student is required to prepare in the laboratory a number of organic compounds, selected to show the characteristic reactions, and to give training in the practical separation and purification of organic substances. After this synthetic work, the students are given a practical course in organic analysis.

SPECIAL COURSES

Special Courses

40. Architectural Drawing I

An elementary course, including the fundamental principles underlying all kinds of mechanical and architectural drawing; geometrical problems; orthographic and isometric projections; classical moldings; Roman alphabet and roof problems.

In connection with this course the instructor will outline a course of reading in architectural history.

41. Architectural Drawing II

Preparation: 40

The orders of Architecture. Practical architecture and details of construction. In this course the student is taught the component parts of buildings. Typical details of construction are drawn to a large scale and in isometric projection.

42. Architectural Drawing III

Preparation: 41

This course covers the making of complete plans, elevations and working drawings of some elementary problem.

Special Students

Students desiring special work in Architectural Drawing not outlined above, should consult with the instructor.

43. Radio Communication

This is a lecture course with demonstrations, given three periods per week for fourteen weeks (the course being repeated during the second term of the School), covering the elementary theory of electricity, motors and generators as used in radio working, ether waves, oscillating circuits, transmitting and receiving apparatus, arrangement of circuits, etc., as applied to both telegraphic and telephonic communication.

44. Radio Code and Practice, Elementary

This course is given three evenings per week for fourteen weeks and is repeated during the second term. It is intended for men who have little or no acquaintance with the code, and

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aims to bring such men up to a receiving speed of at least fifteen words per minute. A knowledge of the various message forms and regulations is also taught, together with the working of the simple sending and receiving sets.

45. Radio Code and Practice, Advanced

This course is also given three evenings per week for fourteen weeks and is repeated during the second term. It is open only to men who can already receive at the rate of twelve words per minute and is intended to carry them up to a receiving speed of at least twenty-two words per minute. It aims to teach all that is necessary to make them accomplished and skilled operators.

Men taking the elementary course during the first half year and entering this course in the second half should by the end of the year be capable of excellent work.

In these two courses in Radio Code and Practice which are under the supervision of Mr. R. G. Porter, who was on the teaching staff of the U. S. Naval Radio School at Cambridge until its termination, use will be made of the methods of instruction developed by the officers of that school assisted by the Department of Psychology of Harvard University and which have proved exceedingly efficient. A chart of normal progress is mapped out, and each man's progress in receiving is plotted from week to week, so that each man knows whether he is gaining as he should or not, and it can be determined very quickly whether or no he can develop into a speedy operator.

46. Radio Laboratory

This course will be given in connection with the regular courses in electrical laboratory work, and will consist of experiments on motor and generator action, motor control and maintainance storage batteries, etc., covering those special matters which are essential and applicable to the intelligent care and operation of the electrical machines used in transmitting sets.

47. Concrete Construction

A course in the theory and practice of concrete construction. It includes the design of buildings, bridges and va-

EQUIPMENT OF THE SCHOOL

rious types of plain and re-inforced concrete structures.

An especially prepared text has been written for this course, in order to meet the demands of men who have not had the advantages of an ideal preparation. This text will be supplemented by lectures, slides and inspection trips of actual work.

EQUIPMENT

The School is now housed in the new building of the Association, and has very exceptionally equipped quarters for carrying on the work of the Engineering Courses.

MECHANICAL ENGINEERING DEPARTMENT

Our steam engineering plant is completely equipped with meters, scales, indicators and all the necessary accessory equipment for making complete boiler tests, and determining the efficiencies of the various appliances used in generating power, heat and light for our new building. This places at the disposal of our classes a perfectly equipped, up-to-date engineering department, and gives them the means of carrying on boiler tests, determining the efficiencies of various fuels and oils, taking indicator diagrams, determining the efficiency of modern reciprocating engines and turbines when direct connected to generators, as well as renders them familiar with all the various auxiliary appliances of such a plant, as condensers, pumps, air compressors, etc. The students also have the use of the equipment of our Automobile School, thus having opportunity to study the most advanced ideas in gasoline engine practice.

CIVIL ENGINEERING DEPARTMENT

Field Instruments

For work in the field the Civil Engineering Department possesses various surveying instruments, representing the principal makes and types of instruments in general use. The

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equipment includes transits, levels, compasses, plane table outfits, Locke hand levels, flag poles, leveling rods, stadia rods, engineers' and surveyors' chains, steel and cloth tapes and other accessories. For higher surveying there is an aneroid barometer for barometric leveling, and a sextant reading to ten seconds for hydrographic surveying. The transits are equipped with neutral glasses and reflectors for astronomical observations.

There have recently been added to the equipment a Keuffel & Esser 6 $\frac{3}{4}$ " transit, a Buff & Buff 4 $\frac{3}{4}$ " Mountain transit, a Keuffel & Esser 18" Wye level, two surveyors' compasses and a Gurley Electric Current meter for hydraulic measurements, as well as all the miscellaneous apparatus necessary to equip the extra parties that the new instruments would accommodate.

The extent of the equipment and scope of the field work itself are designed to train the student's judgment as to the relative merits of the various types of field instruments.

Design and Drafting Rooms

The School possesses large, light and well-equipped drawing rooms for the carrying on of the designing and drafting, which form so important a part of civil engineering work. These rooms are supplied with lockers containing the drawing supplies, and files containing blue prints and photographs of structures that represent the best practice. Many of the prints and photographs are of structures erected in and about Boston.

ELECTRICAL ENGINEERING DEPARTMENT

Electrical Measurements Laboratory

This is equipped with apparatus fundamentally planned for teaching the principles of measurement, rather than for the precise determination of quantitative results. Nevertheless it is necessary for the proper performance of work in the other laboratory courses that a certain amount of careful quantitative work should be done, and the equipment is being steadily increased and developed with both ends held in view.

Apparatus is available for instruction in the following: Resistance by Ohm's law, substitution and direct reflection, voltmeter methods for high resistance, insulation resistance,

EQUIPMENT OF THE SCHOOL

specific resistance, slide wire bridge, Wheatstone bridge, current by electrolysis, electrostatic capacity, inductance, Poggendorf's method of E M F comparison, etc., under the first head, and for work under the second head there is considerable apparatus, among which may be mentioned a conductivity bridge, a Laboratory standard Wheatstone bridge, a Kelvin low-resistance bridge, a Leeds Northrup potentiometer with two standard Weston cells, volt box and steady source of high voltage for voltmeter calibration, numerous standard shunts and a 600 ampere hour storage battery for ammeter calibration, a commutator and leads for use with the Cary-Foster method and a chemical balance.

The Instrument Room is supplied with four General Electric 300-150-15 DC voltmeters, and four double-range Weston's, four single-range ammeters, six millivoltmeters with twelve interchangeable shunts of various ranges up to 100 amperes, all of high grade, together with numerous similar instruments of cheaper quality for lower-class work. For alternating current testing there are:

Three General Electric type P-3 single-phase wattmeters with double voltage and current ranges arranged for Y connection; two polyphase wattmeters of similar type and ranges, one of similar type specially constructed for measurement of core loss, three integrating wattmeters and one rotating standard.

Three 300-volt, three 150-volt and three 50-volt voltmeters.

Three 40-ampere, three 25-ampere, three 15-ampere, three 10-ampere, three 5 ampere and three 1-ampere ammeters, these all being in groups of three for polyphase work; and a laboratory standard AC voltmeter with extension coils.

There is also a considerable amount of auxiliary apparatus such as frequency indicators, synchrosopes and power factor meters.

Electrical Engineering Laboratory

This is equipped with numerous machines of different types, the size and voltage ratings being selected to reduce as much as possible the risk from large voltage and power apparatus, while at the same time availing the student of apparatus of commercial sizes such that the various quantities it is desired to measure will be of reasonable dimensions.

Small machines are used mostly for this reason, and also

EVENING SCHOOL OF ENGINEERING

because the students in their engineering practice come in contact with the large sized and varied machinery of modern power houses and electrical plants continually.

Among the machines of this department are a pair of specially made matched machines, constructed to operate as single, two or three phase generators or motors, as well as synchronous converters, or double-current generators. On the direct-current side, these machines will operate as shunt, series or compound generators, either two or three-wire, or as shunt, series or compound motors. There is a 15 H.P. Westinghouse compound motor, a 3 K.W. compound generator, a 1 K.W. series generator, a 5 H.P. General Electric interpole motor, a 5 H.P. General Electric series motor, a 4 H.P. shunt motor, two 3 H.P. shunt motors, and a 2 H.P. shunt motor; also a $7\frac{1}{2}$ kv-a. special General Electric alternator driven by a 10 H.P. General Electric interpole motor, and a 5 kv-a. Holtzer-Cabot alternator driven by a 10 H.P. Fort Wayne shunt motor. This last machine has two special rotors, permitting its use as a squirrel-cage or phase-wound, induction motor. In addition, there is a 5 K.W. Holtzer-Cabot three-phase synchronous converter, a 5 H.P. General Electric induction motor, which can be operated two or three phase, a 15 kv-a. three-phase alternator, giving practically a pure sine wave, and three General Electric transformers, each of 3 kv-a. capacity. During the past year there have been added three special 1 K.W. single-phase transformers, with leads arranged to give various types of transformer primary and secondary connections, also a set of reactances for making up three-phase inductive loads with extremely low power factor, and a similar set of condensers.

There is also available for advanced instruction, in co-operation with the Mechanical Engineering Department, the four three-wire generators in the main generating plant. Three of these generators are driven by Ridgeway reciprocating engines and one by a Westinghouse-Parson turbine.

Physics Laboratories

The Physics Department has been very completely equipped with all necessary apparatus for the experimental work that is required of the students, as well as that required for lecture demonstration. There is a large laboratory, together with a lecture room devoted entirely to Physics. Among other things

EQUIPMENT OF THE SCHOOL

have been added verniers, levels, spherometers, calorimeters, thermometers, pyrometers, a spectroscope, a microscope, a spectrometer, balances, standard gram weight, lecture table galvanometer, optical disk with all accessories, lenses, photometer, a full set of Weather Bureau apparatus, including a barograph, thermograph, hygrometer, barometer, maximum and minimum thermometers, etc. These, in addition to the equipment already owned, give a wide range to the experimental work that can be done.

Chemical Laboratories

The School has three laboratories completely equipped in all respects for carrying on all lines of chemical work, from that of a high school to that of most advanced college grade. They have accommodations for over one hundred and fifty students, and are suitably furnished with all the necessary appliances for chemical work. Some of these are: hoods, drying closets, a still, steam and hot-water baths, electrolytic circuits, vacuum and pressure apparatus, balances, combustion furnaces, and complete sets of apparatus for the sampling and analysis of flue gases and fuels. There are also testing machines for oils, viscosimeters, and different sorts of flash point apparatus. A chemical museum is connected with this department, where are kept specimens for purposes of illustration.

Libraries

The School shares the privileges of the steadily growing Y.M.C.A. Libraries in the Main Building. It also supports a professional library distributed among the various departments. In addition to this, it subscribes to current periodicals on engineering and scientific subjects for the exclusive use of students. All members of the School are entitled to take books from the Boston Public Library, and this offers a very unusual opportunity to our non-resident students.

Department of Physical Training

Our new gymnasium with all the latest modern equipment gives ample accommodation for all students. There is a running track on the grounds adjoining, together with tennis and hand-ball courts; also a large natatorium where swimming is taught by competent instructors. In connection with this department there are also six excellent bowling alleys, which may be used by the students upon the payment of a nominal fee.

COURSES OF STUDY

COURSES OF STUDY

Schedule of Engineering Subjects

(Arranged alphabetically by subjects)

<i>Subject Number</i>	<i>Subject</i>	<i>Evenings</i>	<i>Time</i>
1	Algebra	Mon. and Thurs.	7.00-7.45
32	Alternating Currents, Lectures	Mon. and Thurs.	8.30-9.15
33	Alternating Currents, Laboratory	Tues.	7.00-9.15
36	Analytical Chemistry, Lectures	Mon. and Thurs.	7.00-7.45
37	Analytical Chemistry, Laboratory	Mon. and Thurs. Tues.	7.45-9.15 7.00-9.15
5	Analytical Geometry	Mon. and Thurs.	8.30-9.15
6	Calculus	Mon. and Thurs.	8.30-9.15
7	Chemical Physics	Mon. and Thurs.	8.30-9.15
30	Direct Currents, Lectures	Mon. and Thurs.	7.00-7.45
31	Direct Currents, Laboratory	Tues.	7.00-9.15
26	Foundations	Mon.	8.30-9.15
2	Geometry	Mon.	7.45-8.30
13	Highway Engineering	Tues.	8.30-9.15
27	Hydraulics	Mon. and Thurs.	7.00-7.45
28	Hydraulic Motors	Mon. and Thurs.	7.00-7.45
34	Inorganic Chemistry, Lectures	Mon. and Thurs.	7.45-8.30
35	Inorganic Chemistry, Laboratory	Wed.	7.00-9.15
3	Logarithms and Slide Rule	Mon.	7.45-8.30
23	Machine Drawing	Tues.	7.00-9.15
24	Machine Design	Tues.	7.00-9.15
25	Materials of Construction	Mon. and Thurs.	7.00-7.45
10	Mechanical Drawing	Wed.	7.00-9.15
22	Mechanical Engineering Drawing	Tues.	7.00-9.15
38	Organic Chemistry, Lectures	Wed.	7.00-8.30
39	Organic Chemistry, Laboratory	Mon. and Tues.	7.00-9.15
16	Practical Mechanics	Mon. and Thurs.	7.45-8.30
8	Practical Physics	Mon. and Thurs.	8.30-9.15
9	Practical Physics Problems	Thurs.	7.45-8.30
14	Railroad Engineering	Mon. and Thurs.	8.30-9.15
15	Railroad Engineering, Drawing	Tues.	7.00-9.15
17	Strength of Materials I	Mon. and Thurs.	7.00-7.45

COURSES OF STUDY

<i>Subject Number</i>	<i>Subject</i>	<i>Evenings</i>	<i>Time</i>
18	Strength of Materials II	Mon. and Thurs.	8.30-9.15
21	Structural Design	Tues.	7.00-9.15
19	Structural Drawing	Tues.	7.00-9.15
11	Surveying	Mon. and Thurs.	7.00-8.30
20	Theory of Structures	Mon. and Thurs.	7.00-8.30
29	Thermodynamics	Mon. and Thurs.	7.45-8.30
12	Topographical Drawing	Tues.	7.00-8.30
4	Trigonometry	Mon. and Thurs.	7.00-7.45
40	Architectural Drawing I	Fri.	7.00-9.30
41	Architectural Drawing II	Fri.	7.00-9.30
42	Architectural Drawing III	Fri.	7.00-9.30
43	Radio Communication	Mon., Thurs. and Fri.	7.45-8.30
44	Radio Code and Practice (Elementary)	Mon., Thurs. and Fri. and	7.00-7.45 8.30-9.15
45	Radio Code and Practice (Advanced)	Mon., Thurs. and Fri. and	7.00-7.45 8.30-9.15
46	Radio Laboratory	By assignment	
47	Concrete Construction	Fri.	7.00-9.15

RATES OF TUITION

RATES OF TUITION

Regular Three-Year Courses

The tuition fee for each year of the regular courses shall be sixty (60) dollars, payable as follows:

\$30.00 upon entering
\$15.00 November 15
\$15.00 January 15

The foregoing rates include membership in the Association.

Individual Engineering Subjects

(Arranged alphabetically by subjects)

<i>Course</i>	<i>Tuition</i>
1 Algebra	\$10.00
32 Alternating Currents, Lectures	20.00
33 Alternating Currents, Laboratory	30.00
36* Analytical Chemistry, Lectures	20.00
37* Analytical Chemistry, Laboratory	70.00
5 Analytical Geometry	10.00
6 Calculus	10.00
7 Chemical Physics	20.00
47 Concrete Construction	20.00
30 Direct Currents, Lectures	20.00
31 Direct Currents, Laboratory	30.00
26 Foundations	10.00
2 Geometry	5.00
13 Highway Engineering	10.00
27 Hydraulics	10.00
28 Hydraulic Motors	10.00
34* Inorganic Chemistry, Lectures	20.00
35* Inorganic Chemistry, Laboratory	30.00
3 Logarithms and Slide Rule	5.00
23 Machine Drawing	15.00
24 Machine Design	30.00
25 Materials of Construction	10.00
10 Mechanical Drawing	15.00
22 Mechanical Engineering Drawing	15.00
38* Organic Chemistry, Lectures	20.00
39* Organic Chemistry, Laboratory	60.00
16 Practical Mechanics	20.00
8 Practical Physics	20.00
9 Practical Physics Problems	10.00
14 Railroad Engineering	20.00
15 Railroad Engineering Drawing	30.00
17 Strength of Materials I	10.00
18 Strength of Materials II	10.00

RATES OF TUITION

<i>Course</i>	<i>Tuition</i>
21 Structural Design	\$30.00
19 Structural Drawing	30.00
11 Surveying	40.00
20 Theory of Structures	40.00
29 Thermodynamics	20.00
12 Topographical Drawing	20.00
4 Trigonometry	10.00

*A laboratory fee of five dollars per year will be charged to each student taking courses in the chemical laboratories. In addition, a laboratory deposit of five dollars will be required. This deposit is returnable upon payment of all breakage and other charges.

Special Courses

40 Architectural Drawing I	\$15.00
41 Architectural Drawing II	15.00
42 Architectural Drawing III	15.00
43 Radio Communication	15.00
44 Radio Code and Practice (Elementary)	20.00
45 Radio Code and Practice (Advanced)	20.00
46 Radio Laboratory	20.00
47 Concrete Construction	20.00

Special Note.—The above rates are in addition to membership (\$2). In case more than one subject is taken, a discount of \$3 for each additional subject will be made.

NORTHEASTERN COLLEGE

SCHOOL OF LAW

Evening Sessions

Established in 1898; incorporated in 1904. Provides a four-years' course in preparation for the Bar, and grants the Degree of Bachelor of Laws.

SCHOOL OF COMMERCE AND FINANCE

Evening Sessions

Established in 1907; incorporated in 1911. Offers the following three- and four-year courses leading to the degree of B.C.S. (Bachelor of Commercial Science): Business Administration and Professional Accountancy. Any one passing the examination for advanced standing is enabled to complete any one of the regular courses and secure the degree in three years. Special courses in addition to regular courses.

CO-OPERATIVE SCHOOL OF ENGINEERING

Day Sessions

Four-year courses in Civil, Mechanical, Electrical and Chemical Engineering, in coöperation with engineering firms. Students earn while learning. Open to high school graduates.

EVENING SCHOOL OF ENGINEERING

Evening Sessions

A school offering three-year courses in Civil, Mechanical, Electrical, Chemical and Structural Engineering.

SCHOOL OF LIBERAL ARTS

Evening Sessions

Courses of college grade in English Composition, Literature, Ancient and Modern Languages, Mathematics, History, Economics, Government, Psychology, Logic, Philosophy, Education, Public Speaking, Journalism and others. Professors and instructors of New England colleges are engaged for this work. This school enables young men to pursue in the evening courses of instruction of the same high standard as those conducted by the best day colleges.

For further information concerning any of the above schools or departments, address

NORTHEASTERN COLLEGE
316 Huntington Avenue, Boston, Massachusetts



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THE EVENING
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ENGINEERING



FOUNDED FOR THE INSTRUCTION
OF MEN IN THE THEORY AND
PRACTICE OF ENGINEERING